

**WHAT IS CLAIMED IS:**

1. A semiconductor optical amplifier for amplifying an input optical signal,  
comprising:

a substrate;

5 a first clad layer deposited on the substrate;

an active layer deposited on the first clad layer and having a plurality of sections  
with different band gaps arranged in a longitudinal direction thereof; and

a second clad layer deposited on the active layer.

2. The semiconductor optical amplifier as set forth in claim 1, wherein the active  
10 layer includes:

a first section for receiving the input optical signal; and

a second section having a band gap lower than that the first section for outputting an  
amplified optical signal.

3. The semiconductor optical amplifier as set forth in claim 1, wherein the active  
15 layer includes:

a first section for receiving an input optical signal; and

a second section having a band gap higher than that the first section for outputting  
an amplified optical signal.

4. The semiconductor optical amplifier as set forth in claim 1, wherein the active layer includes:

first and third sections respectively formed at input and output terminals of the active layer; and

5 a second section, located between the first and third sections, having a band gap lower than those the first and third sections.

5. The semiconductor optical amplifier as set forth in claim 4, wherein the length of the first section of the active layer is substantially longer than that the third section of the active layer.

10 6. The semiconductor optical amplifier as set forth in claim 4, wherein the length of the third section of the active layer is substantially longer than that the first section of the active layer.

7. The semiconductor optical amplifier as set forth in claim 1, wherein the active layer includes:

a plurality of first to N'th sections, connected in series, respectively including active layers having different band gaps,

15 wherein a distribution of band gaps of the active layers is formed in a concave shape so that the band gaps of the first and N'th sections are higher than the band gaps of the second to the (N-1)'th sections located between the first and N'th sections.

8. An optical amplifier module for amplifying an optical signal comprising:

a plurality of first to N'th semiconductor optical amplifiers, connected in series,  
respectively including active layers having different band gaps,

wherein a distribution of band gaps of the active layers is formed in a concave shape

5 so that the band gaps of the first and N'th semiconductor optical amplifiers are higher than  
the band gaps of the second to the (N-1)'th semiconductor optical amplifiers located  
between the first and N'th semiconductor optical amplifiers.

9. The optical amplifier module as set forth in claim 8, wherein the active layer of  
the first semiconductor optical amplifier is made of a material having a band gap higher  
10 than the active layers of the second to (N-1)'th semiconductor optical amplifiers so as to  
prevent the increase of a noise figure.

10. The optical amplifier module as set forth in claim 8, wherein the active layer of  
the N'th semiconductor optical amplifier is made of a material having a band gap higher  
than the active layers of the second to (N-1)'th semiconductor optical amplifiers so as to  
15 prevent the generation of gain saturation in an amplified optical signal.